

## PATENT COOPERATION TREATY



**Translation**

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MIC102WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP2003/013494	International filing date (day/month/year) 01 December 2003 (01.12.2003)	Priority date (day/month/year) 29 November 2002 (29.11.2002)
International Patent Classification (IPC) or national classification and IPC H01M 8/02, 4/94, 8/04		
Applicant MICRONAS GMBH		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08 May 2004 (08.05.2004)	Date of completion of this report 23 August 2005 (23.08.2005)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP2003/013494

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

- ☒ the international application as originally filed
- ☒ the description:  
 pages \_\_\_\_\_ 1-17 \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
 pages \_\_\_\_\_ 1-25 \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement under Article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the drawings:  
 pages \_\_\_\_\_ 1-3 \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☒ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☐ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos. \_\_\_\_\_

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Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: BOX IV.4

Lack of unity of invention

Invention 1: claims 1-7, 13-17, 24

The first invention relates to an electric circuit combined with a fuel cell. The fuel cell stores hydrogen fuel or oxygen reactant in its electrodes.

Invention 2: claims 1-5, 8, 13-16, 18, 24

The second invention describes an electrically driven device with a controller for controlling current flow or energy supply, and an integrated current source. The current source is a fuel cell in whose electrodes hydrogen fuel or oxygen reactant are stored.

Invention 3: claims 1-5, 9-11, 13-16, 19-21, 24

The third invention discloses a fuel cell, a circuit and an electrically driven device with a controller for activating the electrochemical reaction in the fuel cell or for closing the current circuit through the electrodes. The fuel cell stores hydrogen fuel or oxygen reactant in its electrodes.

Invention 4: claims 1-5, 12, 16, 22-24

The fourth invention discloses a fuel cell, a circuit and an electrically driven device with a fuel sensor or reactant sensor for determining the available quantity of fuel or reactant. The fuel cell stores hydrogen fuel or oxygen reactant in its electrodes.

Invention 5: claim 25

The fifth invention describes a sensor for determining

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**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: BOX IV.4

the quantity of fuel or reactant in the vicinity of the sensor and a measurement device for determining the current strength or voltage generated by a fuel cell.

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## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	10, 11, 20, 21	YES
	Claims	1-9, 12-19, 22-25	NO
Inventive step (IS)	Claims		YES
	Claims	1-9, 12-19, 22-25	NO
Industrial applicability (IA)	Claims	1-25	YES
	Claims		NO

### 2. Citations and explanations

#### 1. Citations

- D1: US 2002/098399 A1 (KEPPELER BERTHOLD), 25 July 2002 (2002-07-25) (especially [0011]-[0013]; [0017]-[0019]; [0023]; [0026]-[0029])
- D2: US 2001/033959 A1 (VENKATESAN SRINIVASAN ET AL), 25 October 2001 (2001-10-25) (especially [0018]; [0022]; [0036]-[0038]; [0046]-[0051]; [0055]; [0069]; [0070]; [0074])
- D3: US-A-3 338 746 (GEORG TELSCHOW CARL ET AL), 29 August 1967 (1967-08-29) (especially column 2, line 69 - column 3, line 57; column 4, lines 1-12; claim 1)
- D4: US-A-3 400 305 (COFFMAN SAMUEL W), 3 September 1968 (1968-09-03) (especially column 1, lines 12-14; column 1, lines 50-56; column 4, line 60 - column 6, line 36; figure 1)
- D5: US 2001/016283 A1 (HINOKUMA KOICHIRO ET AL), 23 August 2001 (2001-08-23) (especially [0028]-[0031]; [0041]; [0047]; [0048]; [0087]; [0088]; [0188]; [0268]; [0310]; figures 42, 51, 55, 61, 69, 72, 76)
- D6: EP-A-1 037 183 (E I TECH LTD), 20 September 2000 (2000-09-20) (especially [0005]-[0007]; [0027]-[0029]; figures 1 and 2)

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- D7: US-A-4 164 172 (ANDERTEN JOHN R ET AL), 14 August 1979 (1979-08-14) (especially column 2, lines 5-37; column 2, lines 53-68)
- D8: WO 00/38260 A (ROBERGE RAYMOND; ROSS GUY (CA); CHOUINARD JEAN GUY (CA); POWER ENTERP), 29 June 2000 (2000-06-29) (especially page 3, line 27 - page 6, line 4)

2. Clarity (PCT Article 6)

1.2 Claims 1, 13, 14 and 24 are unclear, since the fuel preparation system or reactant preparation system may also be integrated in the layer adjacent to the electrode, not only in the electrode. In that case, the fuel cell would be a conventional fuel cell.

Moreover, it is unclear whether the words "reactant (O<sub>2</sub>)" or "fuel (H<sub>2</sub>)" in claims 1, 5, 10, 14, 20 and 25 mean that only oxygen is used as reactant and only hydrogen is used as fuel. In that case, the process claims 13 and 24 would also be inconsistent with the product claims 1 and 14, since they proceed only from a reactant and a fuel in general. In that case, dependent claim 16 would be superfluous.

2.2 Claims 6-12 are unclear because they relate to the fuel preparation system of any fuel cells and not to a fuel cell as per claims 1-5 which contains the fuel preparation system.

2.3 Claims 17-23 are unclear because they relate to the reactant preparation system of any fuel cells and not to a fuel cell as per claims 14-16 which contains the reactant preparation system.

2.5 Claim 25 is unclear because the reference sign (1°) is not used in the description or the drawings.

### 3. Novelty (PCT Article 33(2))

3.1 Document D1 discloses a fuel cell in which a fuel such as hydrogen or a reactant such as oxygen is stored in the electrodes ([0011]-[0013]; [0018]-[0019]). The two electrodes are separated by a proton-conducting membrane ([0023]). The fuel cell can thus also be operated as a battery ([0028]). The invention solves the problem of permitting additional energy to be delivered by the accumulated electrochemical capacity, for example when overtaking another car, without the need for an additional battery ([0026]-[0029]). This implies that the fuel cell is coupled to an electric switch which closes the circuit whenever additional energy is required. Claims 1, 2, 4, 5, 13-16 and 24 are therefore not novel.

Moreover, document D1 is detrimental to the novelty of claims 6 and 17 of the first invention, claims 8 and 18 of the second invention, and claims 9 and 19 of the third invention.

3.2 Document D2 describes alkaline fuel cells in which hydrogen is stored in the anode ([0036]-[0038]); [0047]; [0074]) and oxygen is stored in the cathode ([0048]-[0051]; [0055]; [0069]). That concept can also be applied to PEM fuel cells ([0048]). The invention solves the problem of permitting additional energy to be delivered by the accumulated electrochemical capacity, for example when starting a car, and of storing released energy without the need for an additional battery ([0101]-[0105]). This implies that the fuel cell is coupled to an electric switch which closes the circuit whenever additional energy



is required. Claims 1, 2, 4, 5, 13-16 and 24 are therefore not novel.

Moreover, document D2 is detrimental to the novelty of claims 6 and 17 of the first invention, claims 8 and 18 of the second invention, and claims 9 and 19 of the third invention.

3.3 Document D3 discloses an alkaline fuel cell with additional accumulator electrodes to which oxygen and hydrogen are supplied (column 2, line 69 - column 3, line 9). Those fuel preparation systems may contain Pd (column 4, lines 1-12) and are connected to electric switches which are closed whenever the consumer's energy requirements increase (column 3, lines 10-31). The invention solves the problem of permitting additional energy to be delivered to a consumer and of storing energy whenever energy requirements decrease (column 1, lines 11-19). Claims 1-5, 13-16 and 24 are therefore not novel.

Moreover, document D3 is detrimental to the novelty of claims 6 and 17 of the first invention, claims 8 and 18 of the second invention, and claims 9 and 19 of the third invention.

3.4 Document D4 relates to hydrogen-oxygen fuel cells having a polymer electrolyte membrane and semiconductor electrodes (column 6, lines 14-36; figure 1). The semiconductor electrodes are provided with a layer in which oxygen or hydrogen are adsorbed or absorbed and which start and stop the electrochemical reaction when an external control unit emits an electric signal. The layer contains catalysts such as Pt (column 1, lines 50-56; column 4, line 60 - column 6, line 13). The invention solves the problem of permitting said fuel cell to operate

consumers which require an undulating current directly, without the need for conversion (column 1, lines 12-14). Claims 1, 2, 4, 5, 13-16 and 24 are therefore not novel. Moreover, claims 6, 7 and 17 of the first invention, claims 8 and 18 of the second invention, and claims 9 and 19 of the third invention do not meet the requirements of PCT Article 33(2).

3.5 Document D5 discloses fuel cells (designated "air cells" in document D5) which contain a hydrogen-storing carbon electrode and an air electrode separated by a polymer electrolyte membrane ([0031]; [0041]; [0087]; [0088]; [0268]; [0310]; examples 3, 12, 15, 46, 56; figure 40). The hydrogen storage capacity can be increased by catalyst materials such as palladium ([0188]). The invention solves the problem of providing a hydrogen storage material with high storage capacity as well as reduced manufacturing costs and safe, easy handling ([0028]-[0031]). The discharge characteristic of the fuel cells and hence the hydrogen quantity available during discharging are determined (figures 42, 51, 55, 61, 69, 72, 76). This implies that the fuel cell is coupled to an electric switch which closes the circuit at the beginning of the measurement process. Also disclosed is a method for controlling hydrogen storage and release ([0047]; [0048]). The fuel cells are used, for example, for domestic appliances, boats and cars ([0028]). Document D5 is thus detrimental to the novelty of claims 1-5 and 13, and also of claim 6 of the first invention. Moreover, claim 8 of the second invention, claim 9 of the third invention, and claims 12, 22 and 23 of the fourth invention are not novel.

3.6 Document D6 describes an appliance which generates an alarm signal in the event of excessively high carbon

monoxide concentration. The invention solves the problem of providing an alarm generator which permits more effective control of toxic gasses, achieves a simplified test process and more flexible calibration ([0005]-[0007]). The appliance contains a carbon monoxide sensor based on a fuel cell and whose current flow is proportional to CO concentration. A measurement device determines the current intensity or voltage generated by the fuel cell, so that in the event of an electrochemical reaction in the fuel cell, a loudspeaker is activated by a microcontroller ([0027]-[0029], figures 1 and 2). Since claim 25 (fifth invention) includes all fuel cells, not only the fuel cells described in the application, document D6 is detrimental to its novelty.

3.7 Document D7 discloses a device which determines the oxygen content of air by means of a fuel cell. Current flow in the fuel cell is proportional to the oxygen content of air, and fresh air supply is regulated by a control circuit so as to maintain oxygen concentration within particular limits (column 2, lines 5-37). The invention solves, on the one hand, the problem of supplying sufficient fresh air, in order to prevent oxygen content from falling below a threshold value, and, on the other hand, the problem of preventing too much fresh air from being supplied, which would need to be heated or cooled (column 2, lines 53-68). Since claim 25 includes all fuel cells, not only the fuel cells described in the application, document D7 is detrimental to novelty.